7;32;58;84

PILOT CONTROL STUDY

USE OF CACODYLIC ACID IN ENGELMANN SPRUCE--A LETHAL TRAP FOR SUPPRESSION OF SPRUCE BEETLE

Prepared by:

C. Kendall Lister

C. Kendall Lister, Entomologist
Forest Pest Control

Approved by:

A Z Downing — Branch of Forest Pest Control, R-2 — 5-12-72 Date

J E Bennett — Division of Timber Management, R-2 — 5/15/72 Date

B K Emerson — Acting Regional Forester, R-2 — 5/15/72 Date

Carl M. Bentzen — Director, Rocky Mountain Forest and Range Experiment Station — 6/1/72 Date

Director, Forest Pest Control, WO — Date

INTRODUCTION

The use of lethal trap trees for spruce beetle suppression has been evaluated in Regions 2 and 3 for the past 4 years. Lethal traps are obtained by introducing cacodylic acid[1] (dimethylarsinic acid) into the sapstream of spruce which are felled 2 to 4 weeks later to absorb attacking spruce beetles (Dendroctonus rufipennis (Kirby)). In 1969, Buffam[2] in Region 3 obtained complete control of D. rufipennis when undiluted Silvisar 510 (cacodylic acid) was added to hatchet-produced frills in June and the trees were felled in July. In Region 2, Lister[3] introduced undiluted Silvisar 510 to hatchet-frilled Engelmann spruce in early October 1969. These treated trees were felled the following May and an evaluation during July 1971 revealed complete mortality of D. rufipennis had been obtained. In 1971, Buffam[4] found one-half strength Silvisar 510 (1 part tap water with an equal quantity of cacodylic acid) to be as effective for D. rufipennis suppression as treatment with undiluted Silvisar 510. In 1971, Frye and Wygant[5] found that Engelmann spruce treated in late spring with undiluted Silvisar 510 prevented brood development of D. rufipennis.

---

[1] Trade name for solution manufactured by the Ansul Company containing the equivalent of 6.0 lbs. of cacodylic acid/gallon.

[2] P. E. Buffam. Final Report--Pre- and post-flight treatments with cacodylic acid for control of the Engelmann spruce beetle on Mt. Taylor in 1967. Office Report. U.S. Forest Service, Southwestern Region. 4 p. 1969.

[3] C. K. Lister. Use of lethal spruce trap trees to control spruce beetle in a timber sale, East Dallas Creek, Uncompahgre National Forest. Unpublished office data. 1971.

[4] P. E. Buffam. Spruce beetle suppression in trap trees treated with cacodylic acid. J. Econ. Entomol. 64: 958-960. 1971.

[5] R. H. Frye and N. D. Wygant. Spruce beetle mortality in cacodylic acid-treated Engelmann spruce trap trees. J. Econ. Entomol. 64: 911-916. 1971.

METHODS

A study area will be selected by July 1972 in an area having adequate numbers of 1971 infested spruce and adjacent to noninfested spruce. The following criteria must be met: (1) At least fifty 1971-attacked trees--windthrown, felled, or standing--with average brood densities, (2) at least 200 green trees 14" or greater d.b.h. must be within one-half mile of the infested source, and (3) not be logged until August 15, 1974.

Treatment Assignments and Methods.--A total of 200 noninfested Engelmann spruce will be chosen, tagged, and the d.b.h. measured and recorded. Each of the following treatments will be made on ten of these trees and replicated on the time schedule below:

Treatments:

1. Frill and treat with full-strength Silvisar 510.
2. Frill and treat with half-strength Silvisar 510.
3. Frill and treat with quarter-strength Silvisar 510.
4. Frill and treat with tenth-strength Silvisar 510.
5. Check--no frilling or treatment.

Treatment and felling schedule (including check trees):

(1.) Treat August 1-4; fell August 28-31.
(2.) Treat August 28-31; fell September 25-29.
(3.) Treat September 25-29; fell June 4-8, 1973.
(4.) Treat June 4-8, 1973; fell July 2-5.

All trees will be selected and consecutively numbered in the field prior to making treatment assignments as shown in Table 1. Assignments were made with the aid of a random number table. All frills will be made within 18 inches of the ground with a hand hatchet or small ax. Cacodylic acid will then be applied with a plastic squeeze bottle at the rate recommended on the label. Silvisar 510 will be undiluted for full-strength treatments; tap or stream water will be added to obtain half-, quarter-, and tenth-strength solutions. The quantity of cacodylic acid will be recorded for each tree at the time of application.

Post-treatment Evaluation.--In September and October 1973, the study trees will be examined to determine spruce beetle mortality. A series of 6x6-inch bark samples will be taken along the underside of each tree. The samples will be at d.b.h. and at 10-foot intervals along the bole thereafter until a 6-inch diameter is reached. Samples will be examined and the number of gallery starts, inches of egg gallery, live parents, viable eggs, larvae, pupae, and callow adults of spruce beetle will be recorded. Pertinent data of associated insects will also be recorded. The results will be statistically analyzed. Probit analysis will be used to compute a dosage-mortality curve to determine the best dosage rate for this type of treatment. Two-way fractional analysis of variance will be used for comparison of chemical treatment and checks by dates of applications and interactions, plus other individual comparisons. The results will be compared using Duncan's Multiple Range Test, to determine whether differences are significant.

Environmental Impact Evaluation.--The U.S. Fish and Wildlife Service and Wyoming Game & Fish Commission or Colorado Game, Fish and Parks Department (the State contacted will depend on area selected for the test) will be invited to monitor or study the side effects on mammals and birds. It is possible large and small mammals and birds could come in direct or indirect contact with the cacodylic acid. To gauge the relative level of arsenic introduced as a result of this test, samples will be taken from the bark, foliage, and cones of treated and check trees, as well as soil from around the base of these trees. The sample trees selected for arsenic analysis will be the first two trees for each treatment time and dosage rate (see table 1). Bark samples for arsenic analysis will be removed from the following positions along the bole: (1) below the frill, (2) 20 feet, (3) 40 feet, and (4) 60 feet.

A sample of 25 grams of foliage will be collected from the crown immediately after the tree is felled or from underneath it if the foliage has already dropped. If available, 10 spruce cones will be collected from each of the trees treated in 1972 and 1973.

Using a soil auger, soil samples will be taken within the dripline of the designated trees immediately before treatment and after felling. Soil will be taken from the four cardinal directions of each sample tree, mixed thoroughly, and subsampled for analysis. To minimize sample contamination, check trees will be sampled first, followed by tenth-, quarter-, half-, and full-strength treated trees.

All samples for arsenic analysis will be sent to Oregon State University Radiation Center, Corvallis, Oregon, for determinations. Arsenic analysis results will help to determine potential hazard of these treatments to people, animals, and plants, as well as differences in treatment effectiveness.

RESPONSIBILITIES AND MANPOWER REQUIREMENTS

The Branch of Forest Pest Control, Division of Timber Management, Regional Office, Lakewood, Colorado, will be responsible for planning and directing this study. Permission or approval by the Forest officers responsible for management of the test area selected will be obtained before layout and treatment are initiated.

Entomologist Kendall Lister of the Branch of Forest Pest control will direct all phases of the study, with John Schmid, Research Entomologist, and Jake Kovner, Biometrician, Rocky Mountain Forest and Range Experiment Station, Ft. Collins, Colorado, participating in field phases and data analysis. Seasonal employees will assist in the treatment and evaluation sampling. Lister will spend about 40 man days in planning, treating, assessing effectiveness, and reporting of this study.

COST ESTIMATES

Salaries, per diem, and transportation costs of Region 2 and Rocky Mountain Forest and Range Experiment Station permanent personnel will be financed from their respective operating budgets. Cost estimates and seasonals, chemical analysis, and equipment are shown below and will be paid by Region 2.

	Units	Unit Cost	Total cost
Salaries			
2 GS-4 seasonals	80 man days	$26.50	$2,120.00
Travel			
Per diem	72 days	20.00	1,440.00
Vehicle	2500 miles	10¢	250.00
Chemical analysis			
Bark	160 samples	$9	1,440.00
Soil	80 "	"	720.00
Foliage	40 "	"	360.00
Cones	40 "	"	360.00
Subtotal			2,880.00
Equipment			
Silvisar 510	1 gallon	13.25	On hand
Miscellaneous			150.00
TOTAL			$6,840.00

Table 1.--Treatment assignments for spruce lethal trap tree study using cacodylic acid.

Tree No.	Treatment Time*	Dosage	Tree No.	Treatment Time*	Dosage	Tree No.	Treatment Time*	Dosage	Tree No.	Treatment Time*	Dosage
1	3	Check	51	4	Quarter	101	3	Quarter	151	4	Check
2	1	Quarter	52	1	Half	102	3	Half	152	3	Quarter
3	3	Check	53	3	Full	103	1	Quarter	153	2	Tenth
4	1	Half	54	4	Check	104	2	Half	154	3	Half
5	1	Check	55	2	Quarter	105	4	Full	155	4	Tenth
6	1	Full	56	4	Check	106	3	Quarter	156	4	Tenth
7	4	Quarter	57	1	Half	107	3	Tenth	157	4	Check
8	1	Check	58	4	Quarter	108	2	Full	158	3	Tenth
9	3	Tenth	59	1	Tenth	109	1	Tenth	159	1	Quarter
10	1	Full	60	4	Check	110	2	Tenth	160	3	Full
11	2	Half	61	2	Tenth	111	4	Full	161	1	Half
12	4	Quarter	62	4	Half	112	2	Quarter	162	1	Half
13	3	Half	63	2	Check	113	2	Half	163	1	Check
14	1	Full	64	4	Check	114	2	Check	164	1	Full
15	3	Quarter	65	3	Half	115	3	Quarter	165	3	Quarter
16	4	Half	66	3	Full	116	1	Full	166	3	Check
17	2	Check	67	3	Quarter	117	4	Half	167	3	Full
18	3	Full	68	4	Check	118	1	Quarter	168	2	Full
19	1	Half	69	4	Quarter	119	4	Tenth	169	4	Full
20	2	Half	70	1	Full	120	4	Full	170	2	Full
21	2	Quarter	71	1	Check	121	2	Check	171	2	Check
22	2	Check	72	2	Tenth	122	1	Quarter	172	4	Half
23	3	Tenth	73	3	Half	123	2	Half	173	4	Quarter
24	2	Tenth	74	1	Full	124	1	Quarter	174	4	Check
25	4	Tenth	75	2	Full	125	3	Full	175	3	Tenth
26	1	Full	76	1	Check	126	4	Full	176	2	Check
27	1	Half	77	2	Quarter	127	1	Check	177	1	Check
28	4	Half	78	3	Tenth	128	2	Quarter	178	1	Tenth
29	2	Half	79	3	Full	129	1	Check	179	1	Tenth
30	2	Half	80	2	Check	130	4	Full	180	2	Half
31	1	Half	81	4	Tenth	131	4	Half	181	4	Quarter
32	3	Check	82	2	Full	132	4	Tenth	182	3	Full
33	2	Full	83	3	Half	133	1	Check	183	3	Check
34	3	Full	84	3	Tenth	134	2	Half	184	3	Half
35	2	Full	85	4	Check	135	1	Full	185	3	Half
36	2	Tenth	86	4	Full	136	2	Quarter	186	3	Full
37	1	Full	87	4	Check	137	4	Full	187	1	Check
38	4	Quarter	88	2	Full	138	1	Quarter	188	1	Tenth
39	2	Check	89	3	Quarter	139	4	Tenth	189	3	Quarter
40	2	Tenth	90	3	Half	140	2	Tenth	190	4	Quarter
41	2	Tenth	91	3	Check	141	1	Tenth	191	2	Half
42	3	Quarter	92	3	Check	142	2	Quarter	192	4	Full
43	3	Tenth	93	1	Tenth	143	4	Full	193	1	Quarter
44	3	Check	94	4	Tenth	144	4	Half	194	1	Tenth
45	4	Half	95	1	Tenth	145	2	Quarter	195	4	Tenth
46	2	Quarter	96	4	Quarter	146	1	Half	196	3	Half
47	2	Full	97	2	Full	147	4	Tenth	197	4	Half
48	1	Tenth	98	1	Quarter	148	4	Half	198	2	Check
49	1	Quarter	99	2	Tenth	149	2	Quarter	199	3	Tenth
50	3	Check	100	3	Tenth	150	1	Half	200	3	Check

*1 - Treat August 1-4; fell August 28-31
2 - Treat August 28-31; fell September 25-29
3 - Treat September 25-29; fell June 4-8, 1973
4 - Treat June 4-8, 1973; fell July 2-5